FIG. 1

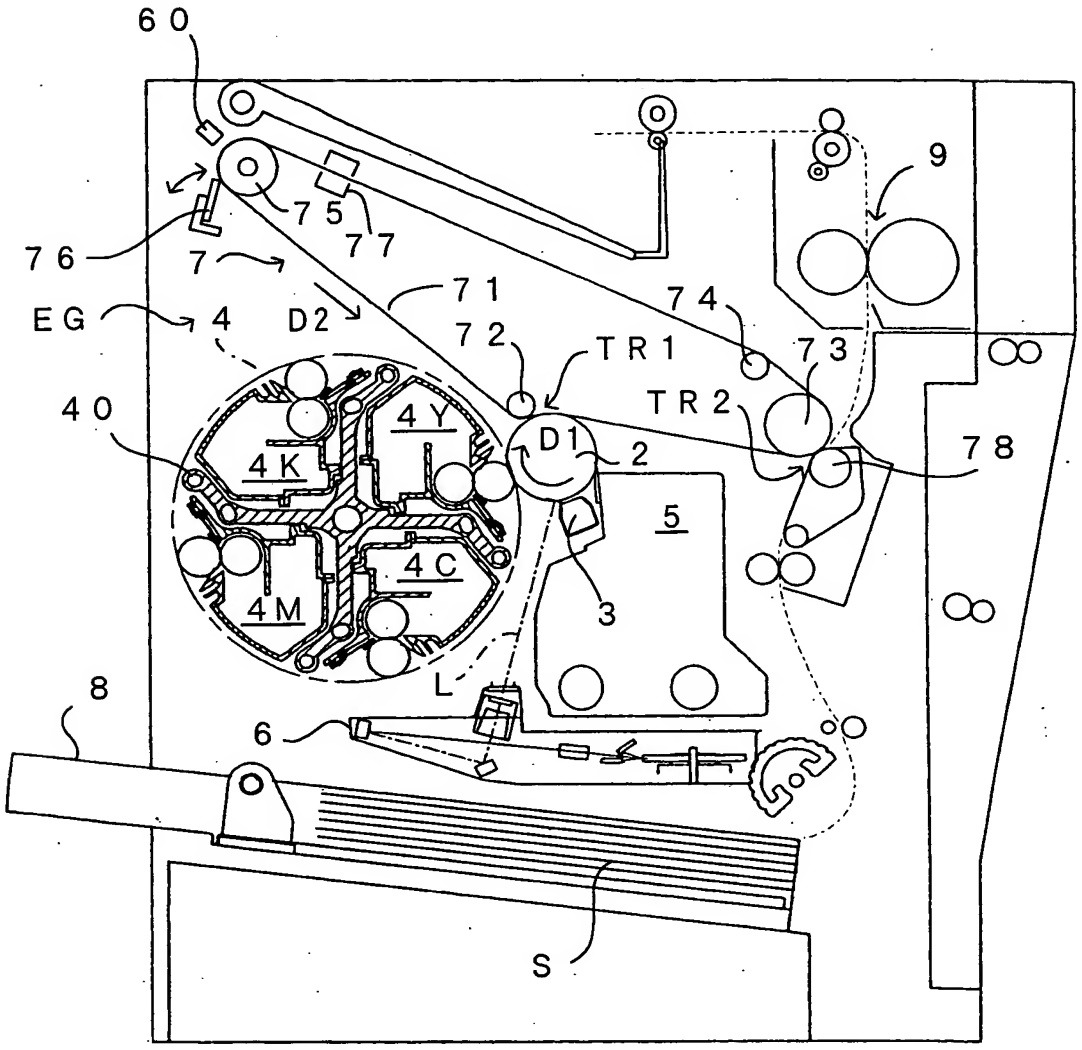

60
9
75
77
76
7
71
74
EG
4
D2
72
TR1
73
TR2
40
4Y
D1
78
2
4K
5
4C
3
4M
L
8
6
S

FIG. 2

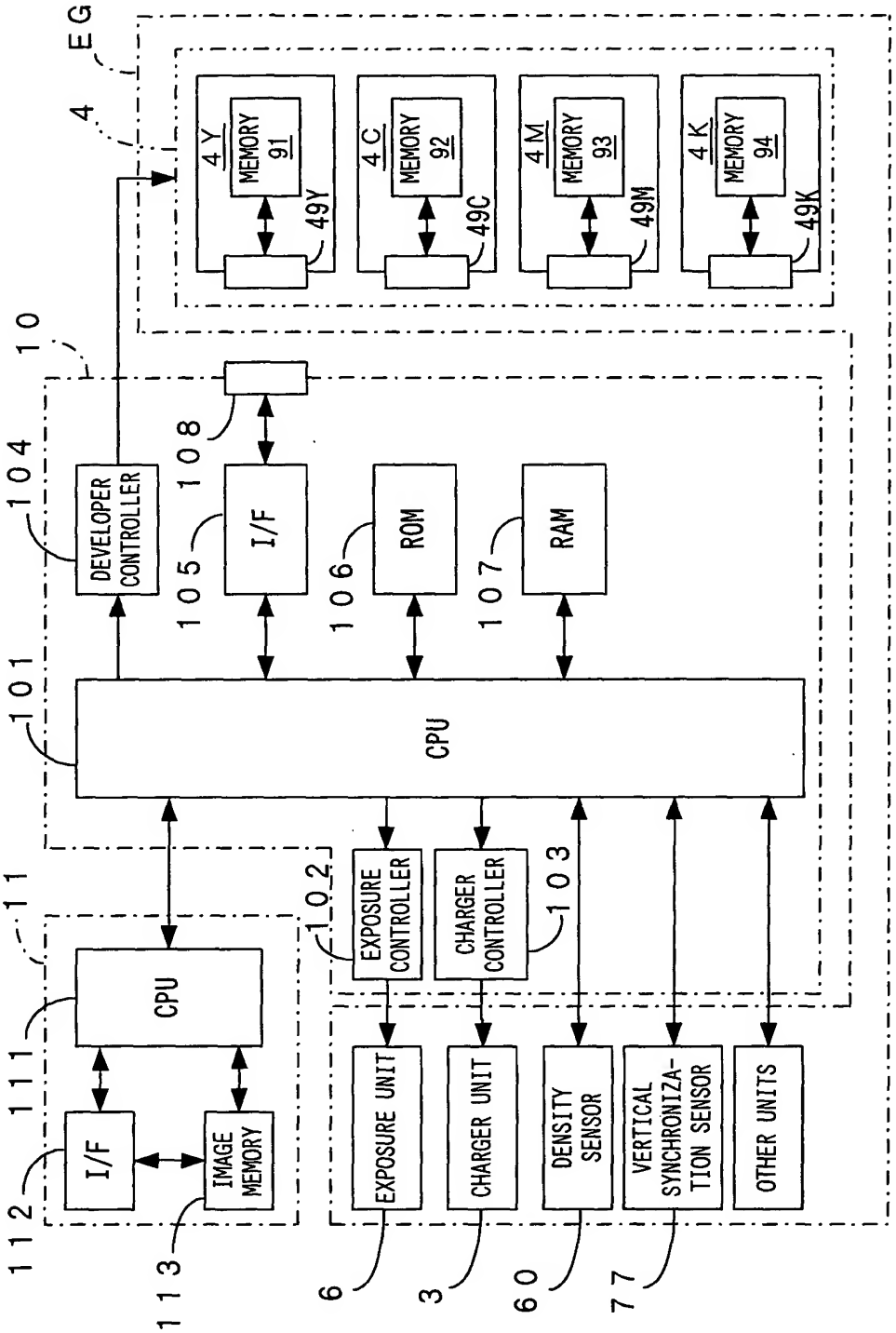

EG
4
4Y MEMORY 91
49Y
4C MEMORY 92
49C
4M MEMORY 93
49M
4K MEMORY 94
49K
10
104
DEVELOPER CONTROLLER
108
105
I/F
106
ROM
107
RAM
101
CPU
11
111
CPU
112
I/F
IMAGE MEMORY
113
102
EXPOSURE CONTROLLER
CHARGER CONTROLLER
103
EXPOSURE UNIT
CHARGER UNIT
DENSITY SENSOR
VERTICAL SYNCHRONIZATION SENSOR
OTHER UNITS
6
3
60
77

FIG. 3

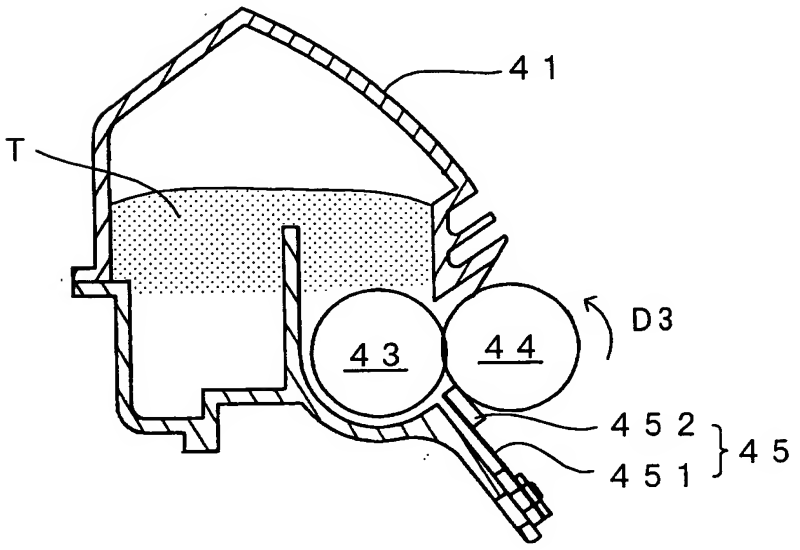


FIG. 4

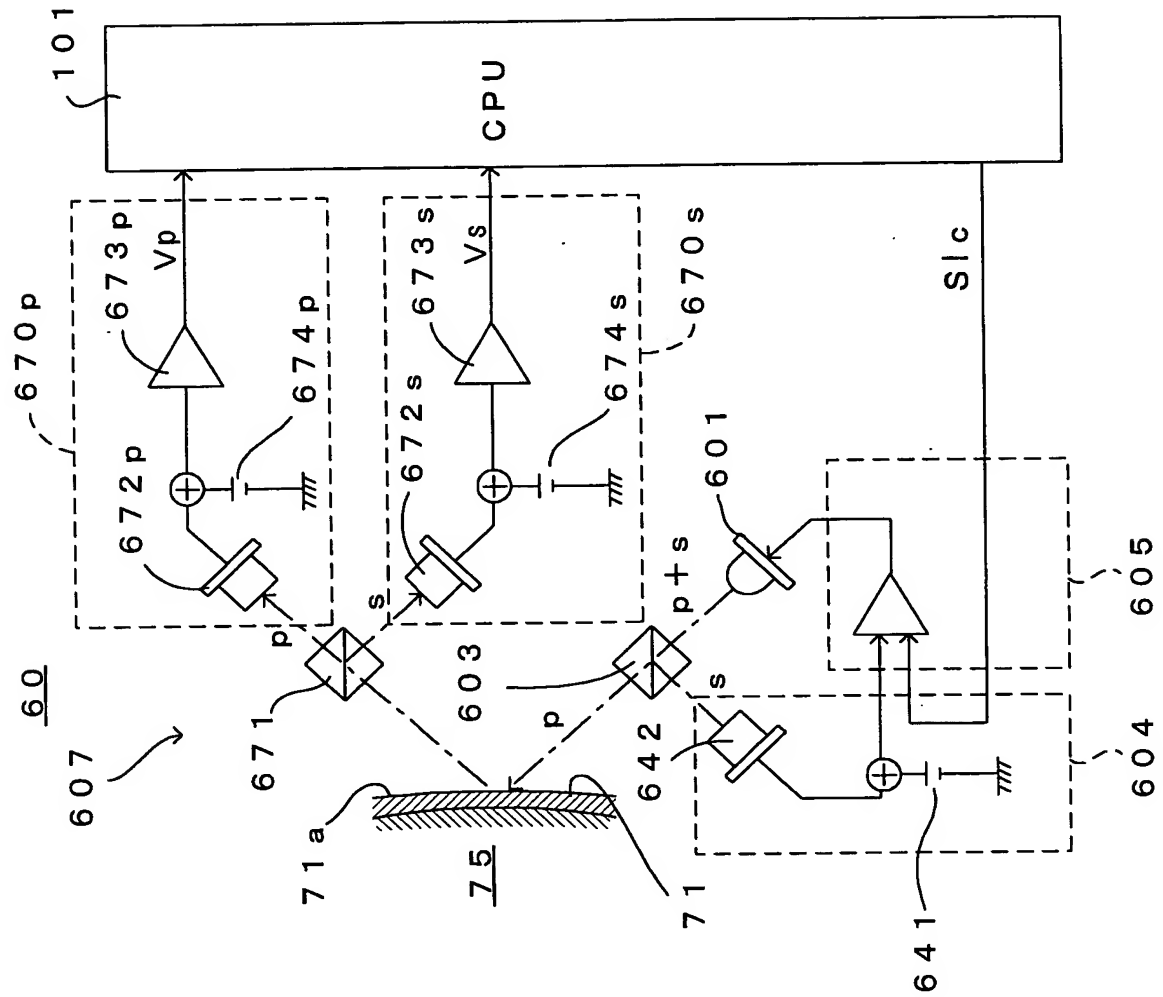

101
CPU
670p
673p
Vp
674p
672p
672s
673s
Vs
674s
670s
Slc
601
605
p+s
603
60
607
671
642
604
641
71a
75
71

FIG. 5

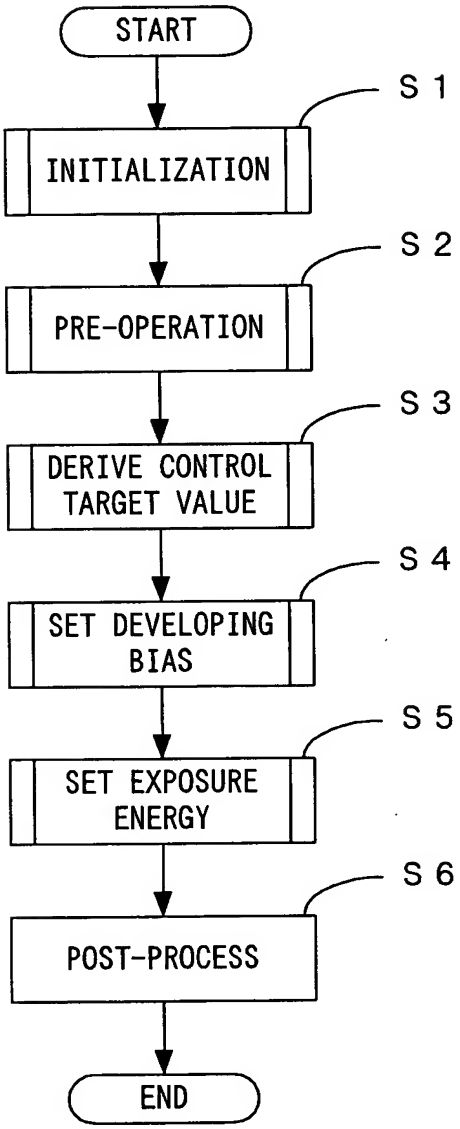

START
S 1
INITIALIZATION
S 2
PRE-OPERATION
S 3
DERIVE CONTROL TARGET VALUE
S 4
SET DEVELOPING BIAS
S 5
SET EXPOSURE ENERGY
S 6
POST-PROCESS
END

FIG. 6

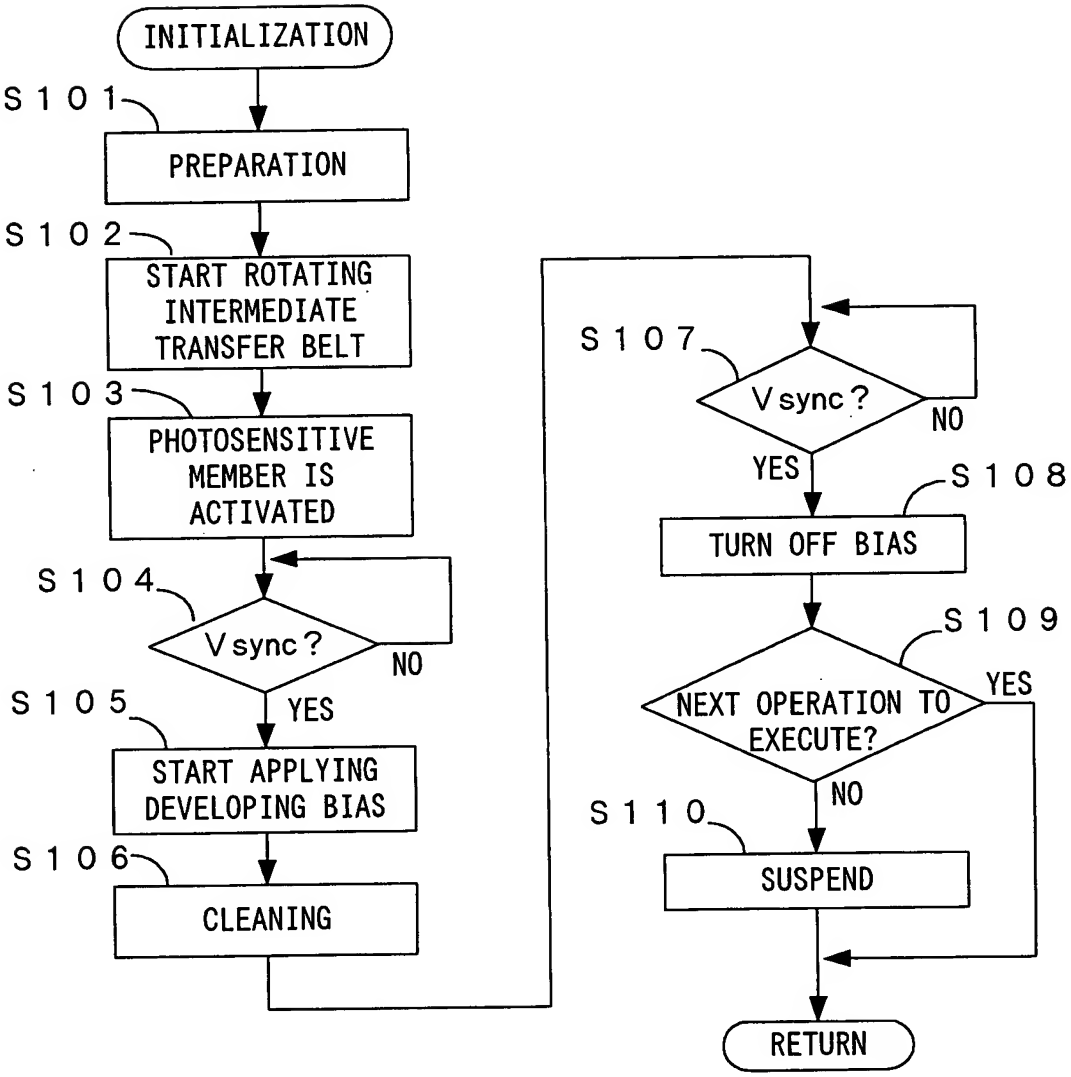

INITIALIZATION
S101
PREPARATION
S102
START ROTATING INTERMEDIATE TRANSFER BELT
S103
PHOTOSENSITIVE MEMBER IS ACTIVATED
S104
V sync ?
NO
YES
S105
START APPLYING DEVELOPING BIAS
S106
CLEANING
S107
V sync ?
NO
YES
S108
TURN OFF BIAS
S109
NEXT OPERATION TO EXECUTE?
YES
NO
S110
SUSPEND
RETURN

FIG. 7

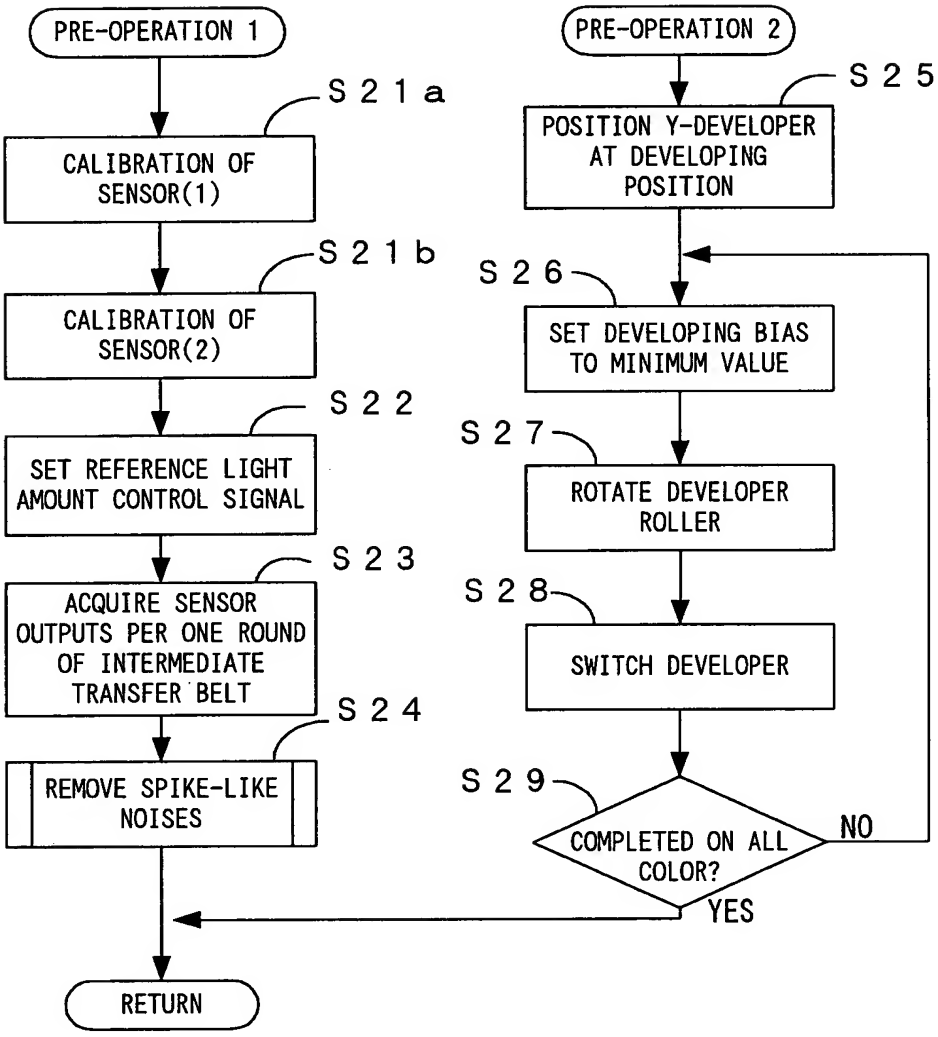

PRE-OPERATION 1
S21a
CALIBRATION OF SENSOR(1)
S21b
CALIBRATION OF SENSOR(2)
S22
SET REFERENCE LIGHT AMOUNT CONTROL SIGNAL
S23
ACQUIRE SENSOR OUTPUTS PER ONE ROUND OF INTERMEDIATE TRANSFER BELT
S24
REMOVE SPIKE-LIKE NOISES
RETURN
PRE-OPERATION 2
S25
POSITION Y-DEVELOPER AT DEVELOPING POSITION
S26
SET DEVELOPING BIAS TO MINIMUM VALUE
S27
ROTATE DEVELOPER ROLLER
S28
SWITCH DEVELOPER
S29
COMPLETED ON ALL COLOR?
NO
YES

FIG. 8A

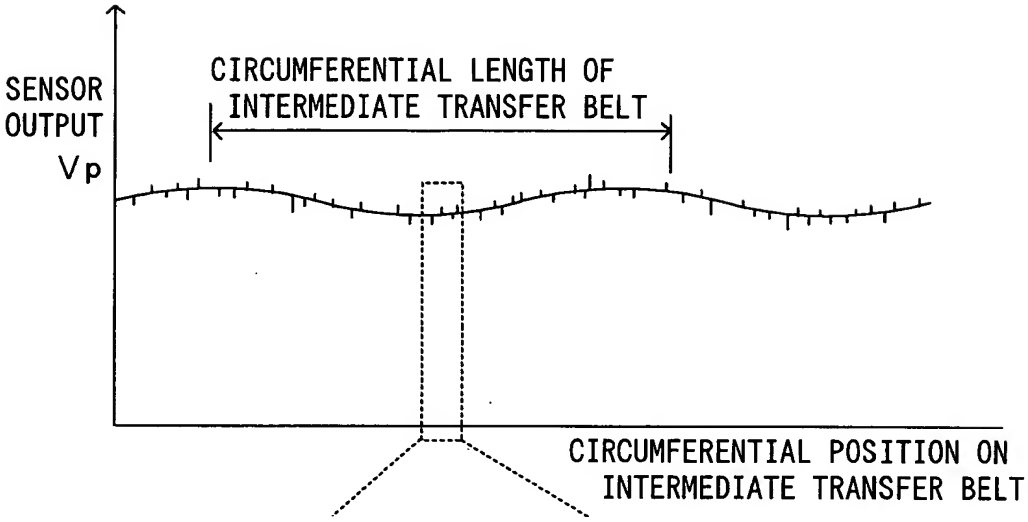

SENSOR
OUTPUT
Vp
CIRCUMFERENTIAL LENGTH OF
INTERMEDIATE TRANSFER BELT
CIRCUMFERENTIAL POSITION ON
INTERMEDIATE TRANSFER BELT

FIG. 8B

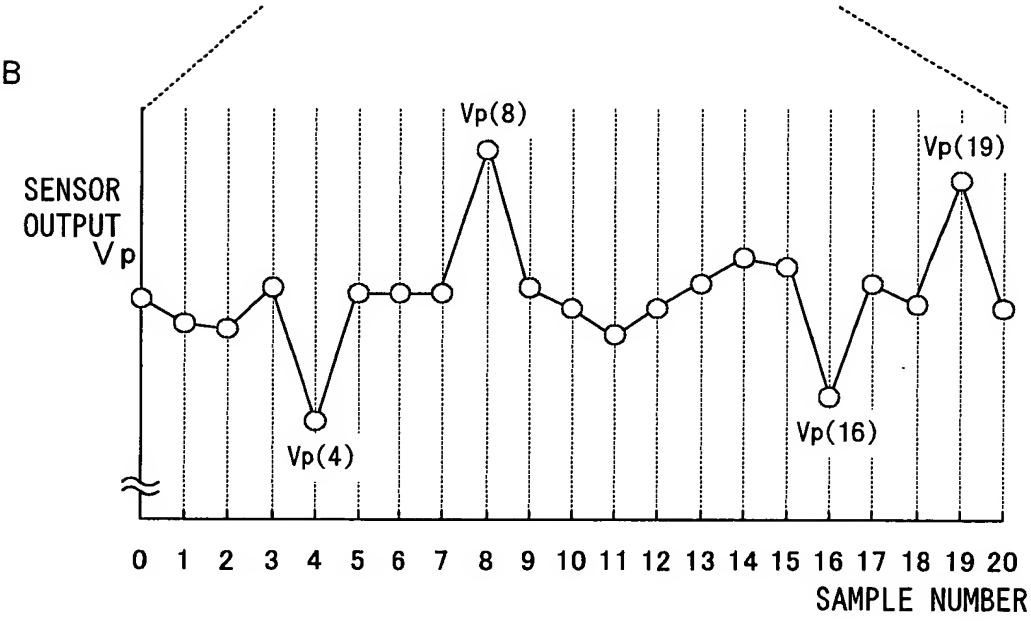

SENSOR
OUTPUT
Vp
Vp(8)
Vp(19)
Vp(4)
Vp(16)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
SAMPLE NUMBER

FIG. 9

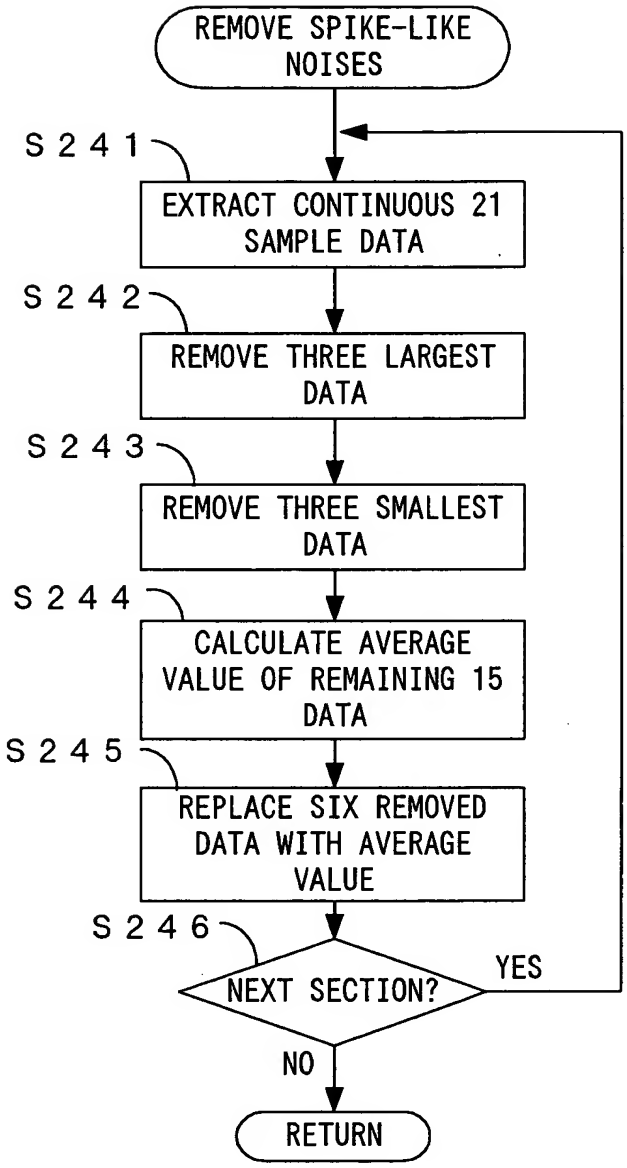

REMOVE SPIKE-LIKE NOISES
S241
EXTRACT CONTINUOUS 21 SAMPLE DATA
S242
REMOVE THREE LARGEST DATA
S243
REMOVE THREE SMALLEST DATA
S244
CALCULATE AVERAGE VALUE OF REMAINING 15 DATA
S245
REPLACE SIX REMOVED DATA WITH AVERAGE VALUE
S246
NEXT SECTION?
YES
NO
RETURN

FIG. 10

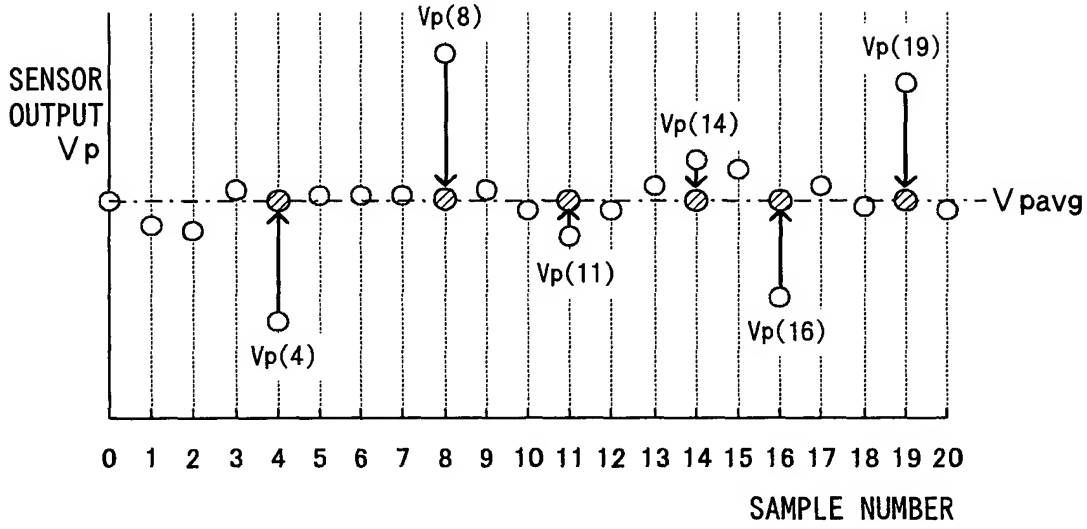

SENSOR OUTPUT Vp
Vp(8)
Vp(19)
Vp(14)
Vp(11)
Vp(4)
Vp(16)
Vpavg
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
SAMPLE NUMBER

FIG. 11A

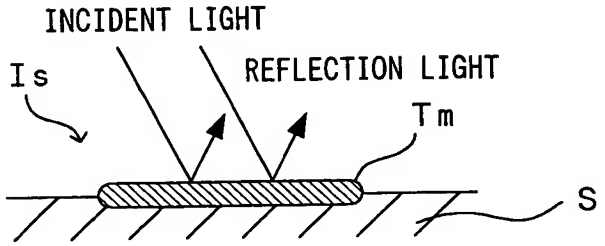


FIG. 11B

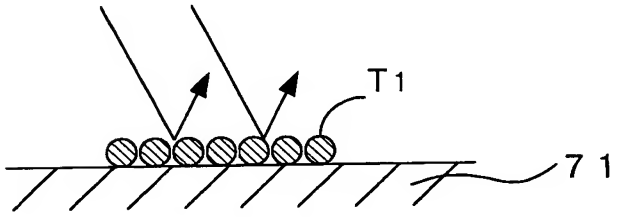


FIG. 11C

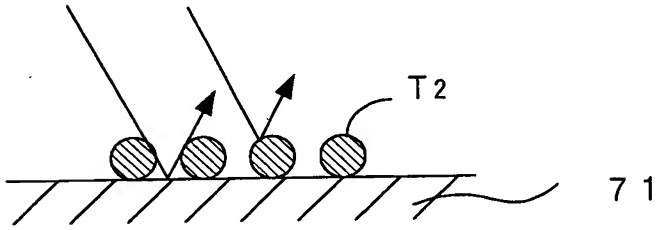


FIG. 12A

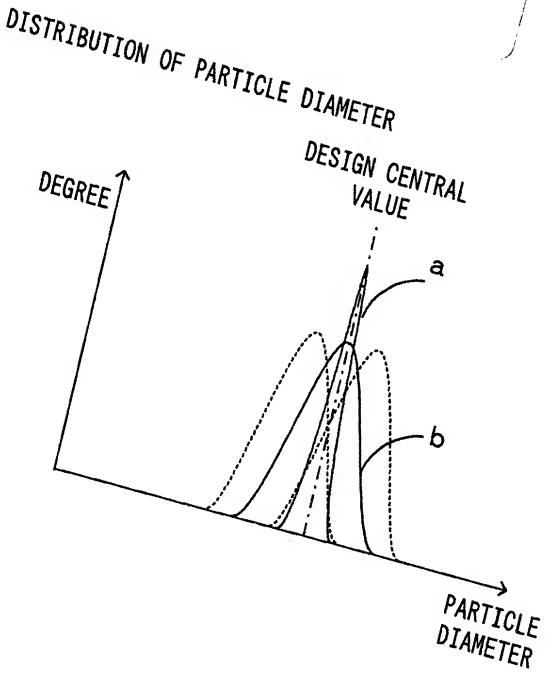


FIG. 12B

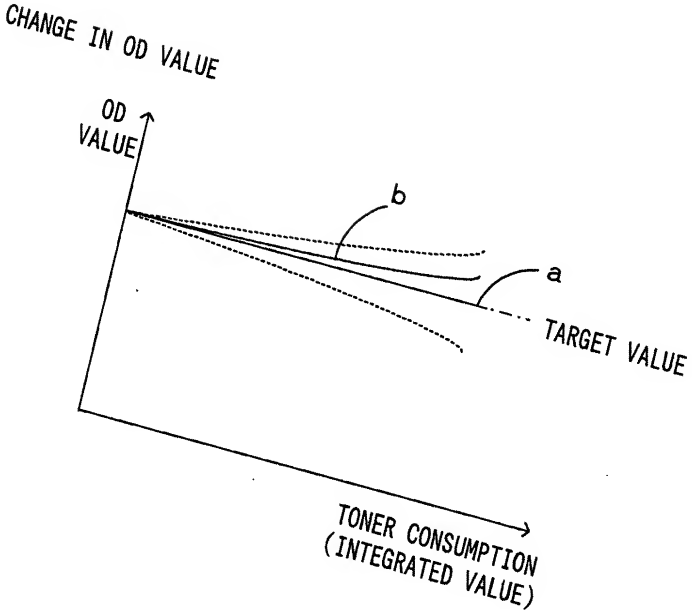


FIG. 13

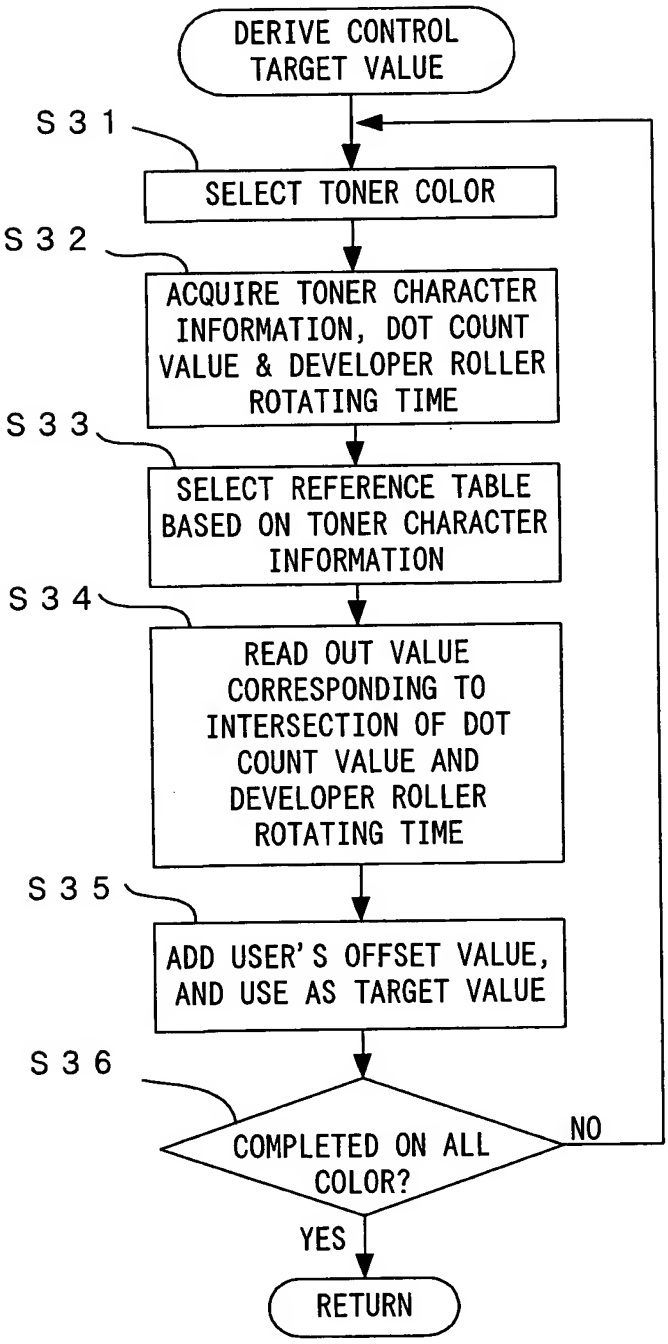

DERIVE CONTROL TARGET VALUE
S31
SELECT TONER COLOR
S32
ACQUIRE TONER CHARACTER INFORMATION, DOT COUNT VALUE & DEVELOPER ROLLER ROTATING TIME
S33
SELECT REFERENCE TABLE BASED ON TONER CHARACTER INFORMATION
S34
READ OUT VALUE CORRESPONDING TO INTERSECTION OF DOT COUNT VALUE AND DEVELOPER ROLLER ROTATING TIME
S35
ADD USER'S OFFSET VALUE, AND USE AS TARGET VALUE
S36
COMPLETED ON ALL COLOR?
NO
YES
RETURN

FIG. 14A HIGH-DENSITY PATCH IMAGE

TONER CHARACTER INFORMATION ="0"		DEVELOPER ROLLER ROTATING TIME (sec)			
		~1325	~3975	~6625	~10600
DOT COUNT VALUE	~1000000	0.990	0.988	0.984	0.982
	~2000000	0.988	0.984	0.982	0.982
	~6666666	0.984	0.982	0.982	0.982
	~12000000	0.982	0.982	0.982	0.982

FIG. 14B LOW-DENSITY PATCH IMAGE

TONER CHARACTER INFORMATION ="0"		DEVELOPER ROLLER ROTATING TIME (sec)			
		~1325	~3975	~6625	~10600
DOT COUNT VALUE	~1000000	0.185	0.182	0.181	0.180
	~2000000	0.182	0.181	0.180	0.180
	~6666666	0.181	0.180	0.180	0.180
	~12000000	0.180	0.180	0.180	0.180

FIG. 15

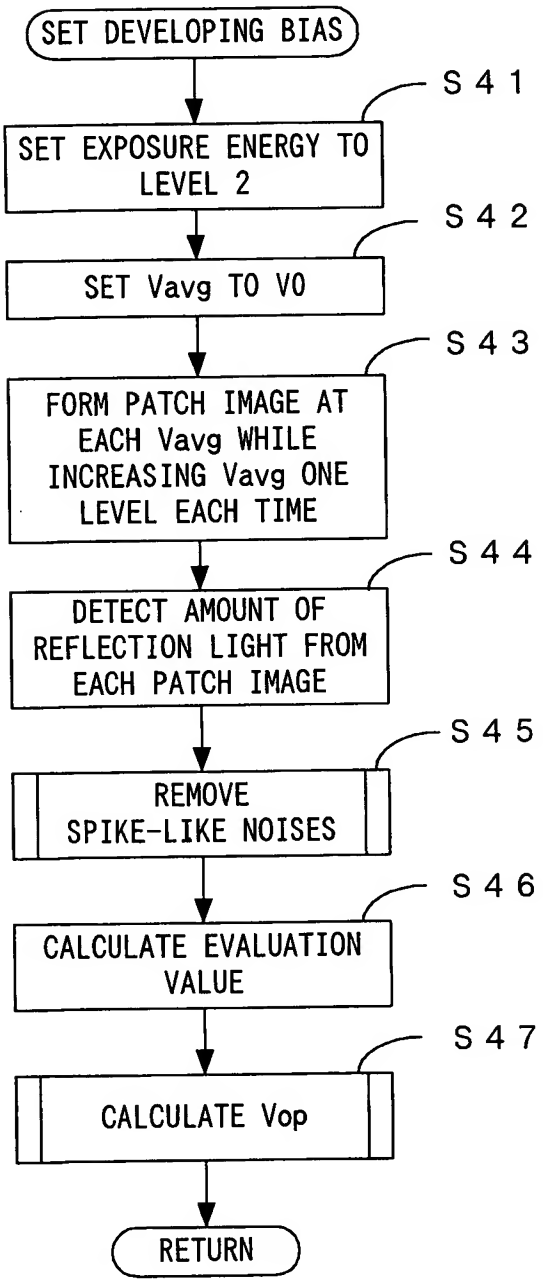

SET DEVELOPING BIAS
S41
SET EXPOSURE ENERGY TO LEVEL 2
S42
SET Vavg TO V0
S43
FORM PATCH IMAGE AT EACH Vavg WHILE INCREASING Vavg ONE LEVEL EACH TIME
S44
DETECT AMOUNT OF REFLECTION LIGHT FROM EACH PATCH IMAGE
S45
REMOVE SPIKE-LIKE NOISES
S46
CALCULATE EVALUATION VALUE
S47
CALCULATE Vop
RETURN

FIG. 16

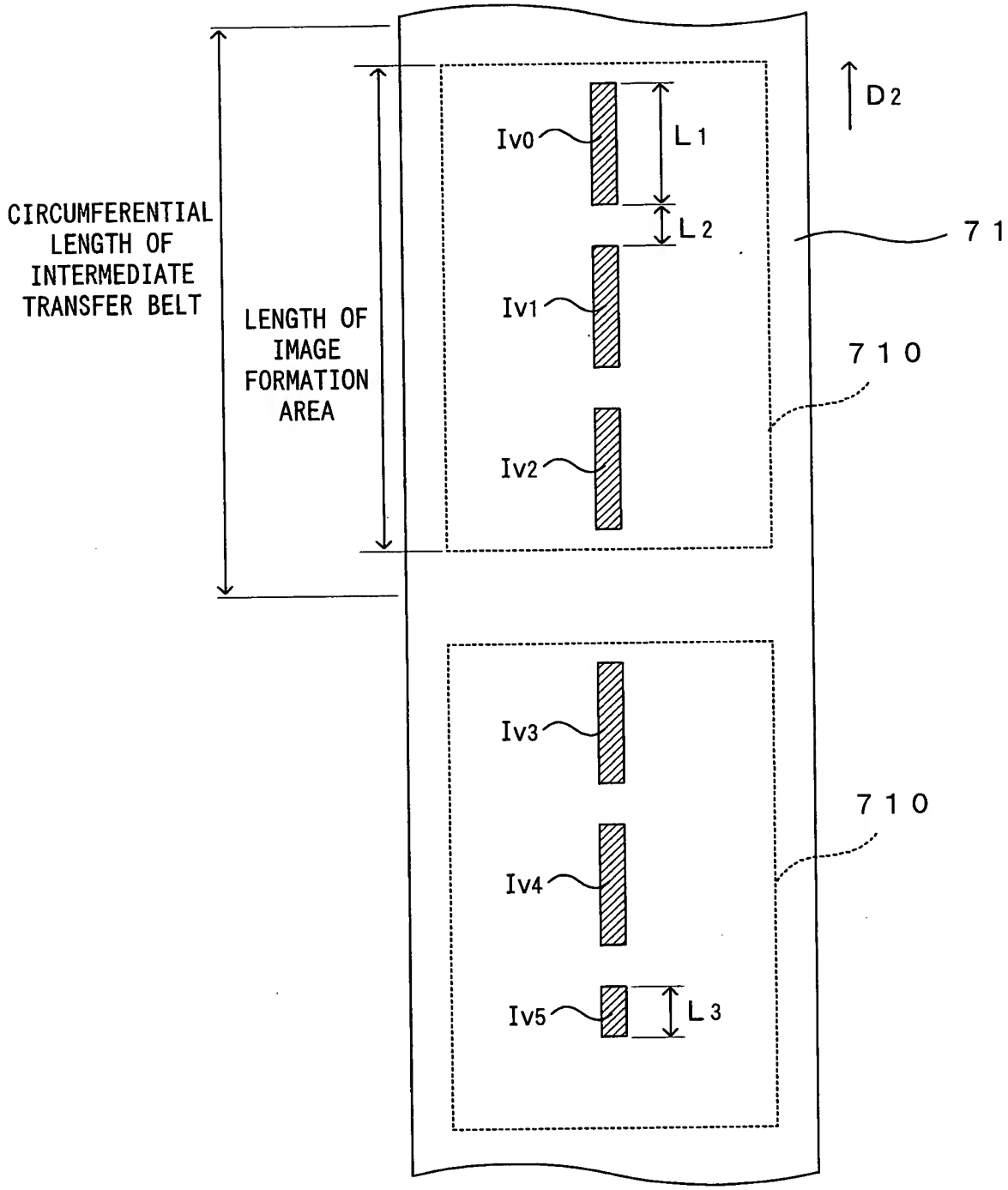

CIRCUMFERENTIAL LENGTH OF INTERMEDIATE TRANSFER BELT
LENGTH OF IMAGE FORMATION AREA
D2
Iv0
L1
L2
Iv1
Iv2
71
710
Iv3
Iv4
Iv5
L3
710

FIG. 17A

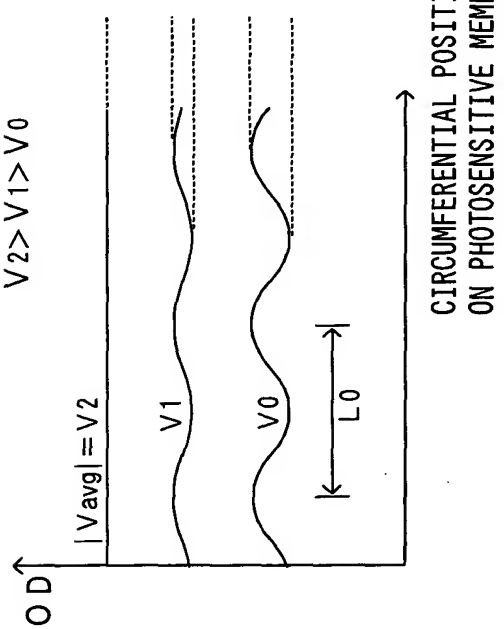


FIG. 17B

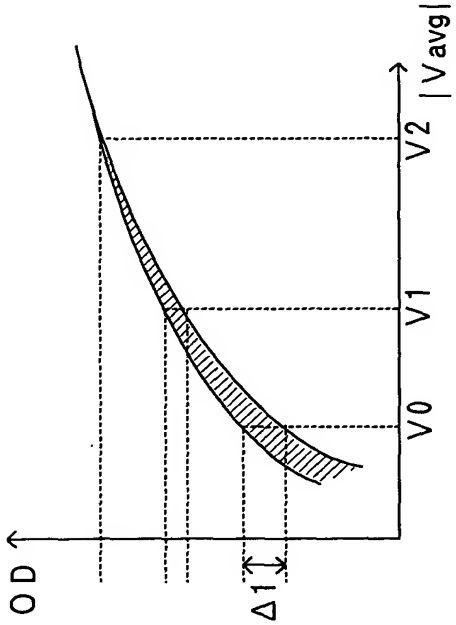


FIG. 18

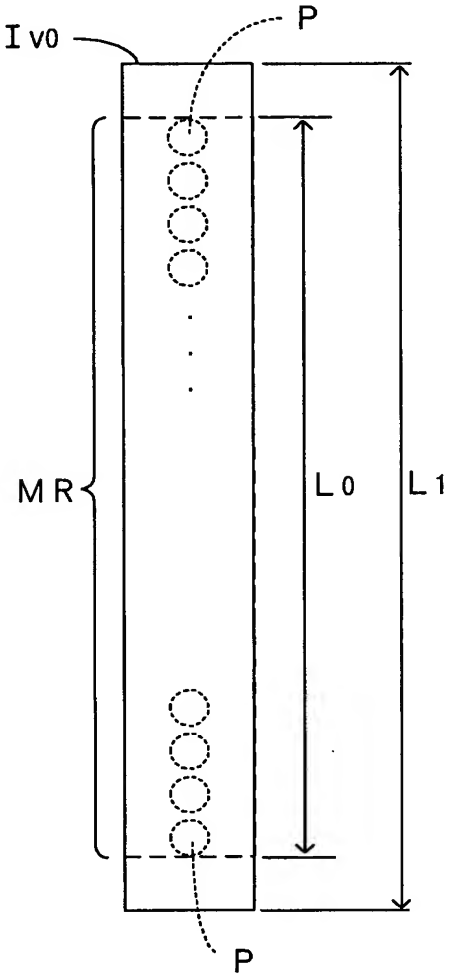


FIG. 19

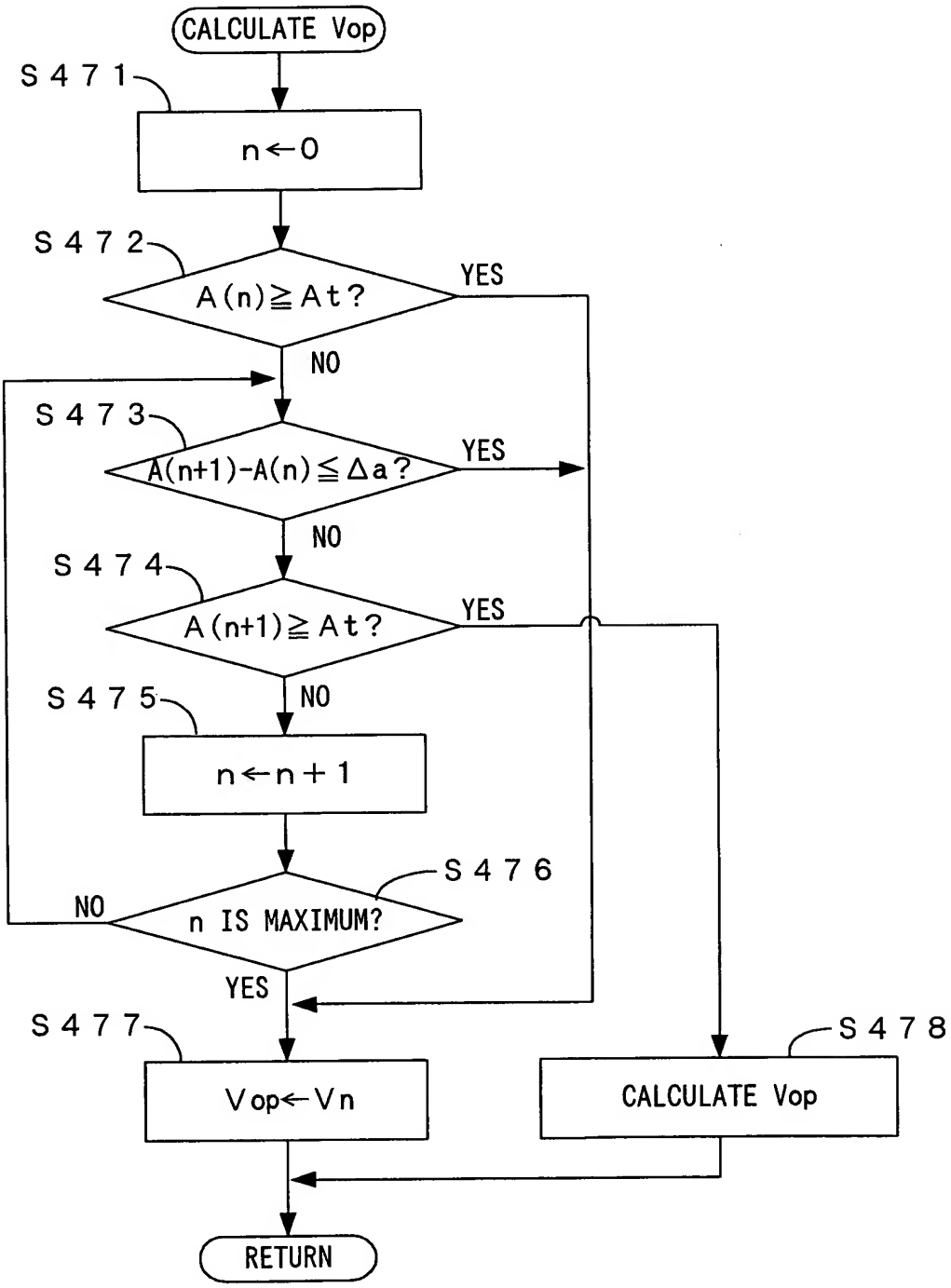

CALCULATE Vop
S471
n←0
S472
A(n)≧At?
YES
NO
S473
A(n+1)-A(n)≦Δa?
YES
NO
S474
A(n+1)≧At?
YES
NO
S475
n←n+1
S476
NO
n IS MAXIMUM?
YES
S477
Vop←Vn
S478
CALCULATE Vop
RETURN

FIG. 20

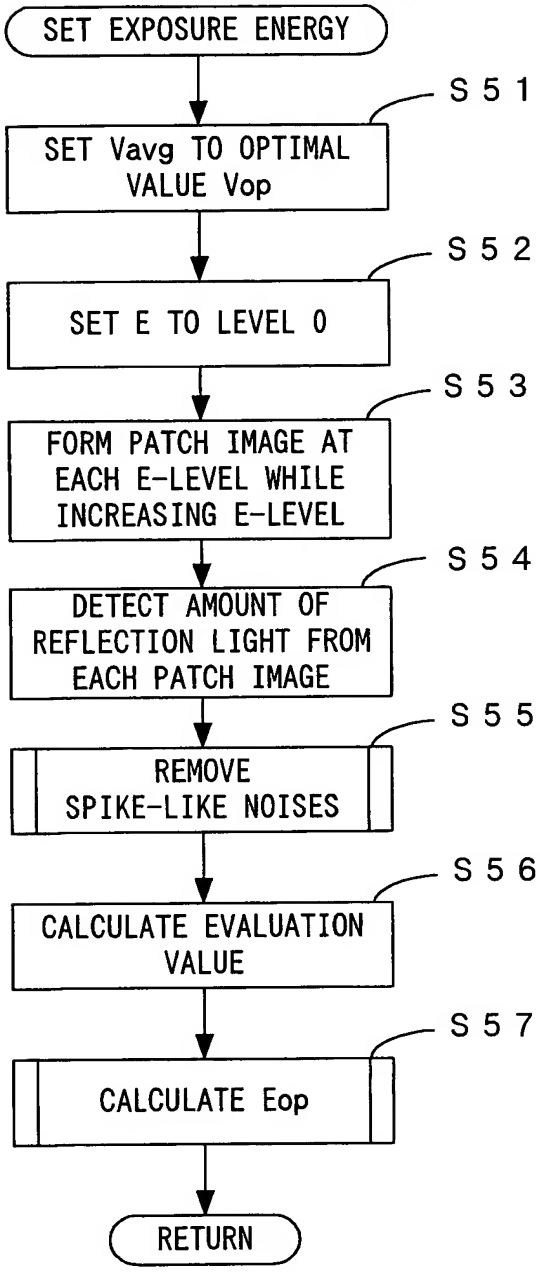

SET EXPOSURE ENERGY
S 5 1
SET Vavg TO OPTIMAL VALUE Vop
S 5 2
SET E TO LEVEL 0
S 5 3
FORM PATCH IMAGE AT EACH E-LEVEL WHILE INCREASING E-LEVEL
S 5 4
DETECT AMOUNT OF REFLECTION LIGHT FROM EACH PATCH IMAGE
S 5 5
REMOVE SPIKE-LIKE NOISES
S 5 6
CALCULATE EVALUATION VALUE
S 5 7
CALCULATE Eop
RETURN

FIG. 21

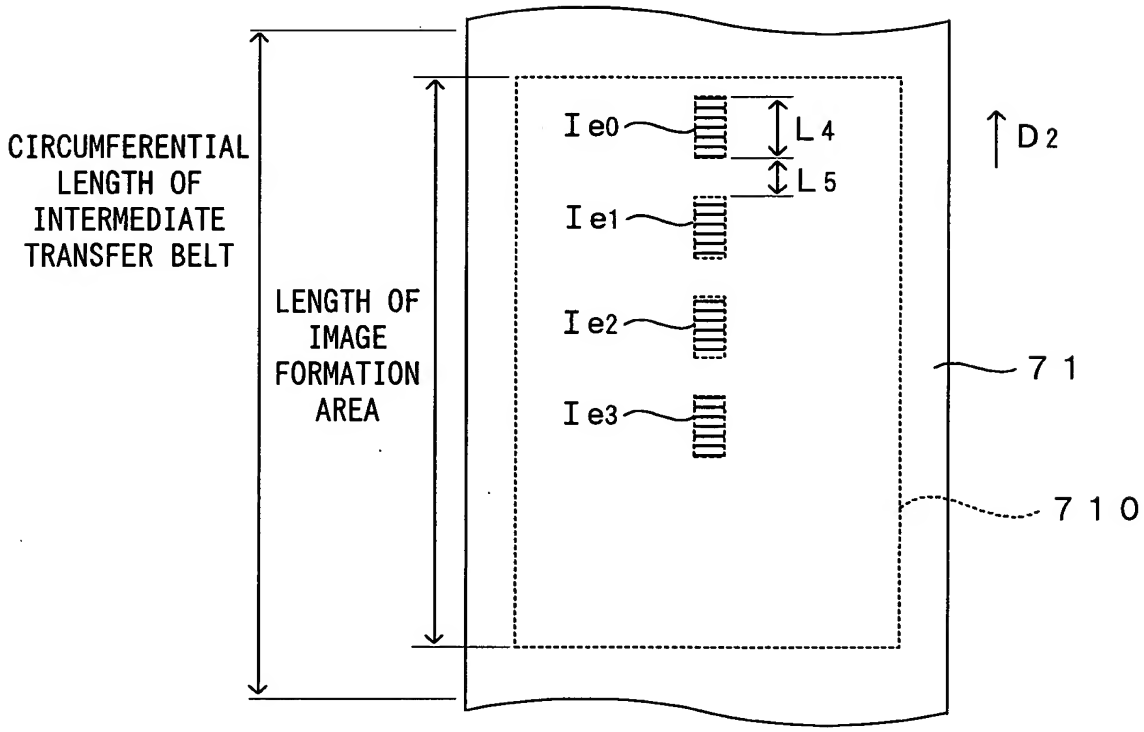

CIRCUMFERENTIAL LENGTH OF INTERMEDIATE TRANSFER BELT
LENGTH OF IMAGE FORMATION AREA
Ie0
Ie1
Ie2
Ie3
L4
L5
D2
71
710

FIG. 22

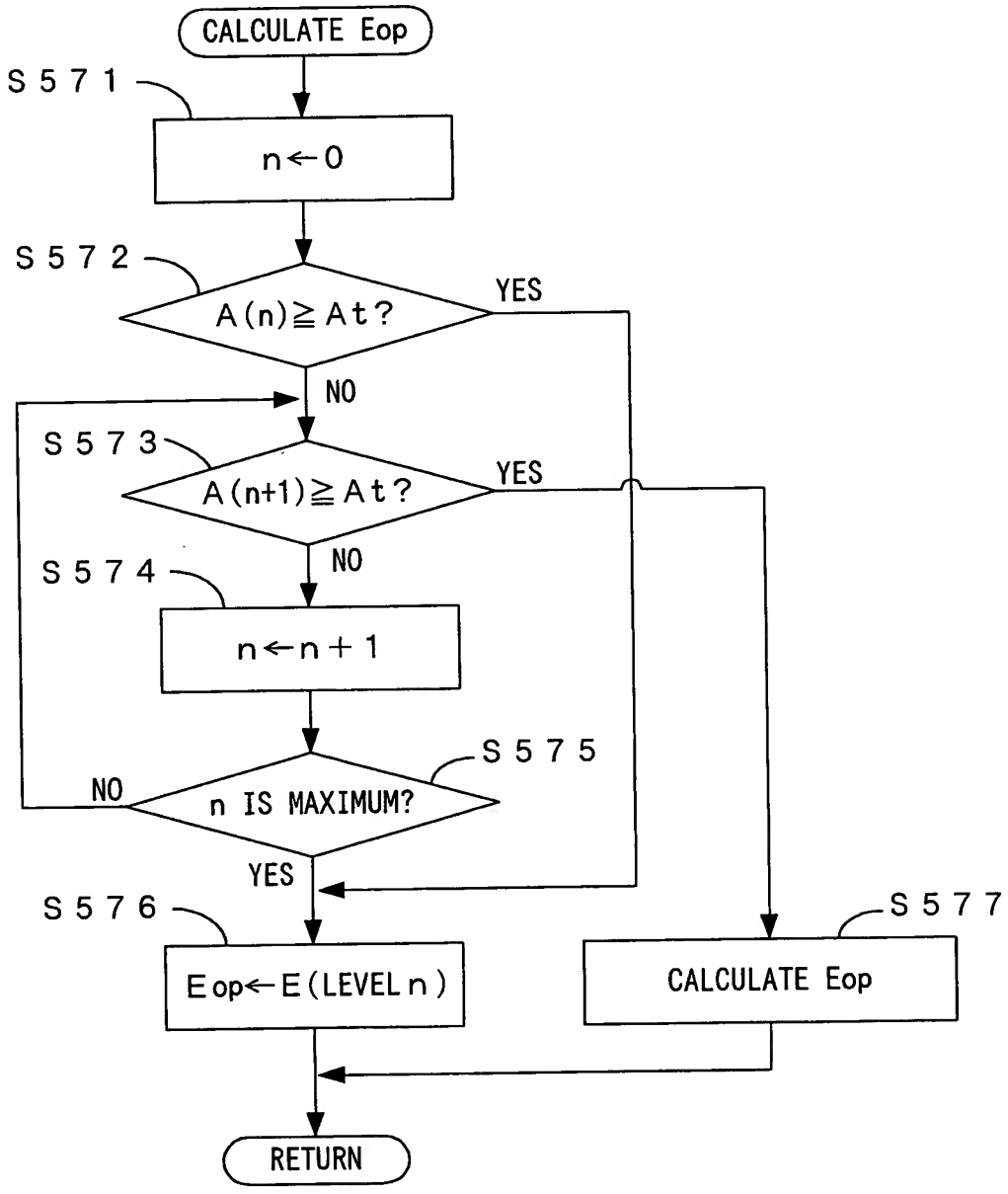

CALCULATE Eop
S571
n←0
S572
A(n)≧At?
YES
NO
S573
A(n+1)≧At?
YES
NO
S574
n←n+1
S575
n IS MAXIMUM?
NO
YES
S576
Eop←E(LEVEL n)
S577
CALCULATE Eop
RETURN

FIG. 23

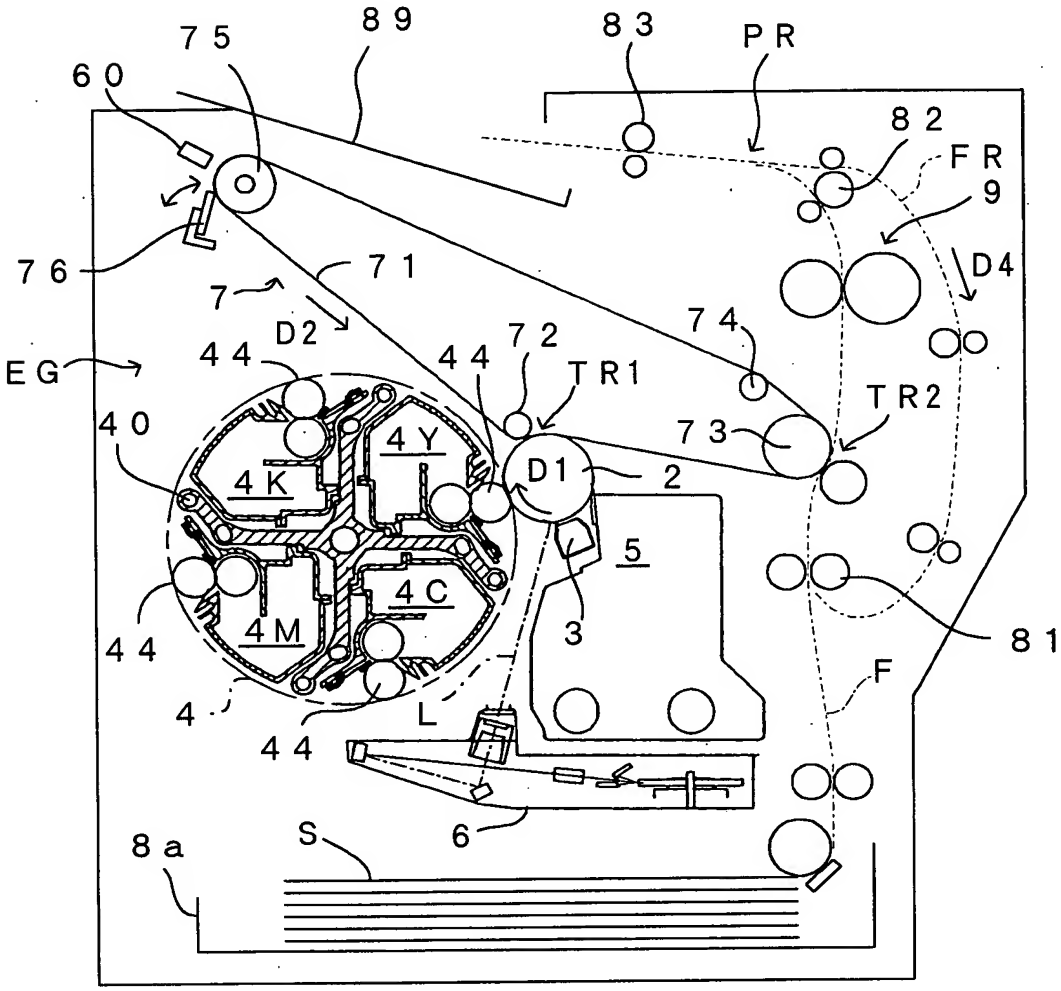

75
89
83
PR
60
82
FR
9
76
71
7
D4
D2
74
72
44
44
TR1
EG
TR2
40
4Y
73
4K
D1
2
5
4C
3
81
4M
44
F
4
L
44
6
8a
S

FIG. 24

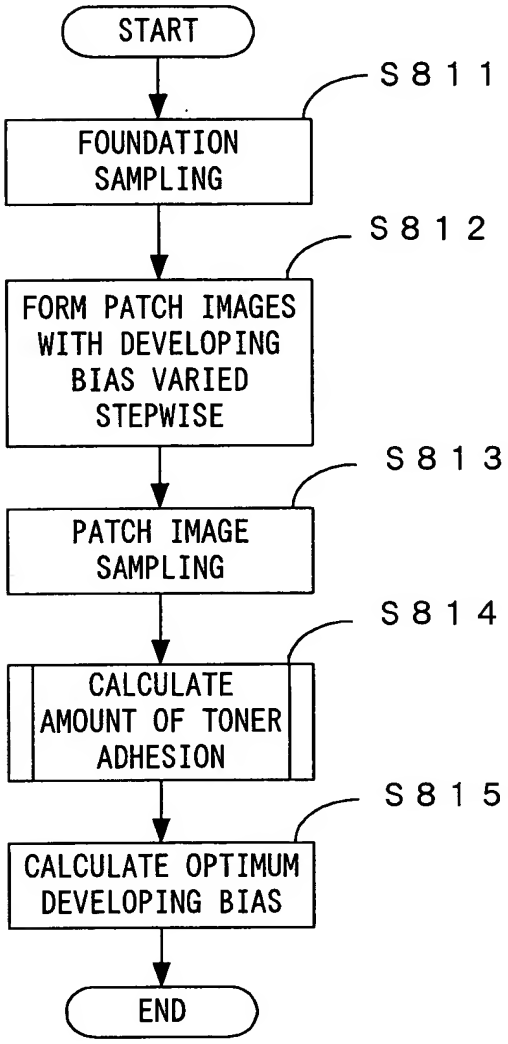

START
S811
FOUNDATION SAMPLING
S812
FORM PATCH IMAGES WITH DEVELOPING BIAS VARIED STEPWISE
S813
PATCH IMAGE SAMPLING
S814
CALCULATE AMOUNT OF TONER ADHESION
S815
CALCULATE OPTIMUM DEVELOPING BIAS
END

FIG. 25A

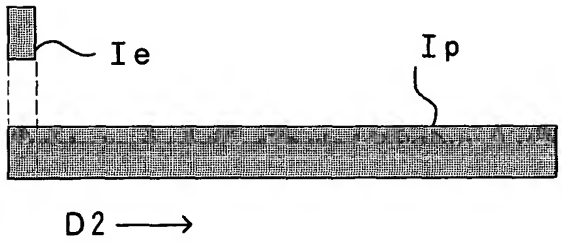


FIG. 25B

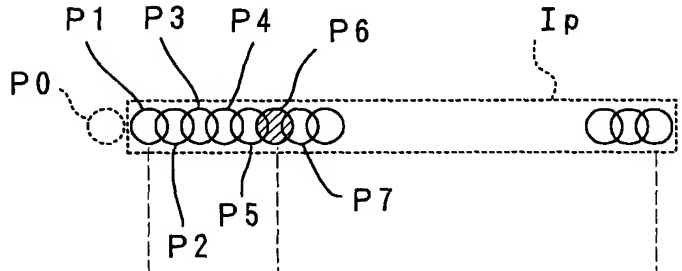


FIG. 25C

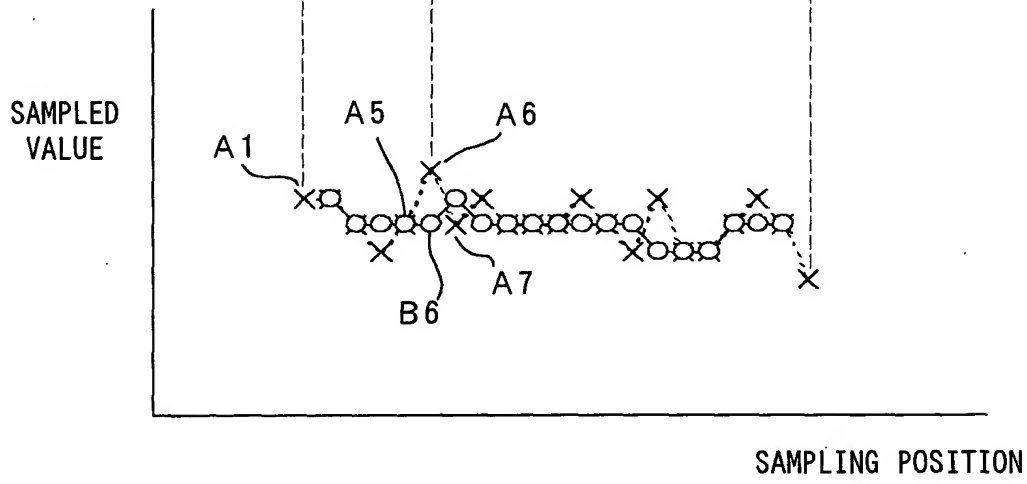


FIG. 26

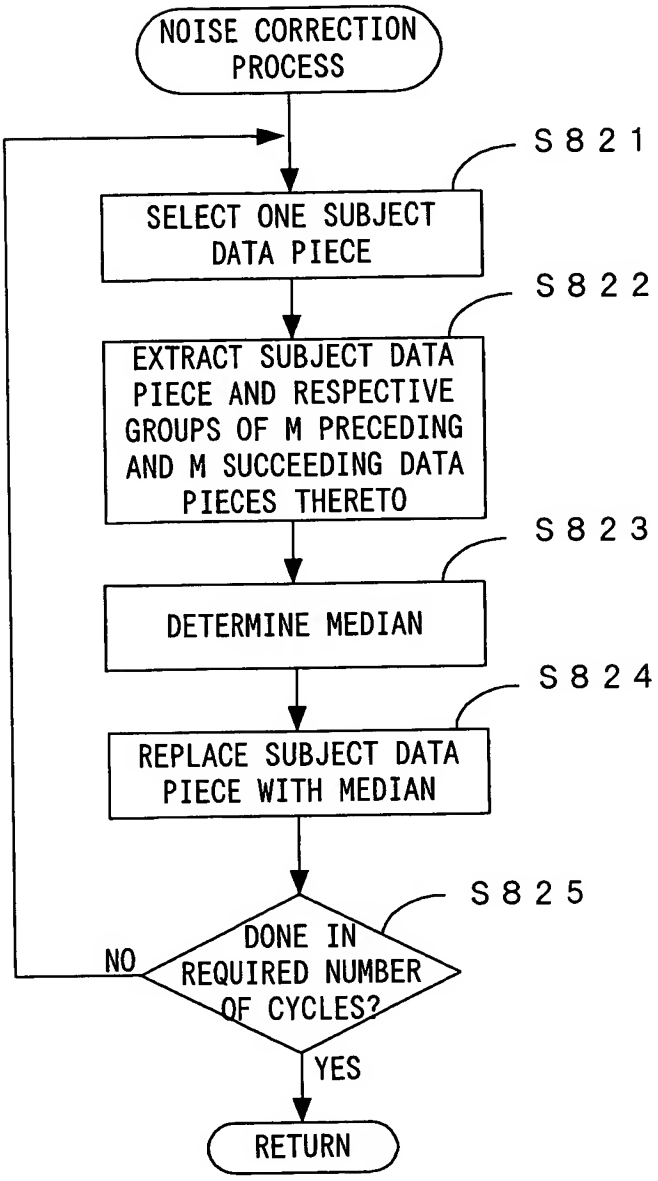

NOISE CORRECTION PROCESS
S821
SELECT ONE SUBJECT DATA PIECE
S822
EXTRACT SUBJECT DATA PIECE AND RESPECTIVE GROUPS OF M PRECEDING AND M SUCCEEDING DATA PIECES THERETO
S823
DETERMINE MEDIAN
S824
REPLACE SUBJECT DATA PIECE WITH MEDIAN
S825
DONE IN REQUIRED NUMBER OF CYCLES?
NO
YES
RETURN

FIG. 27

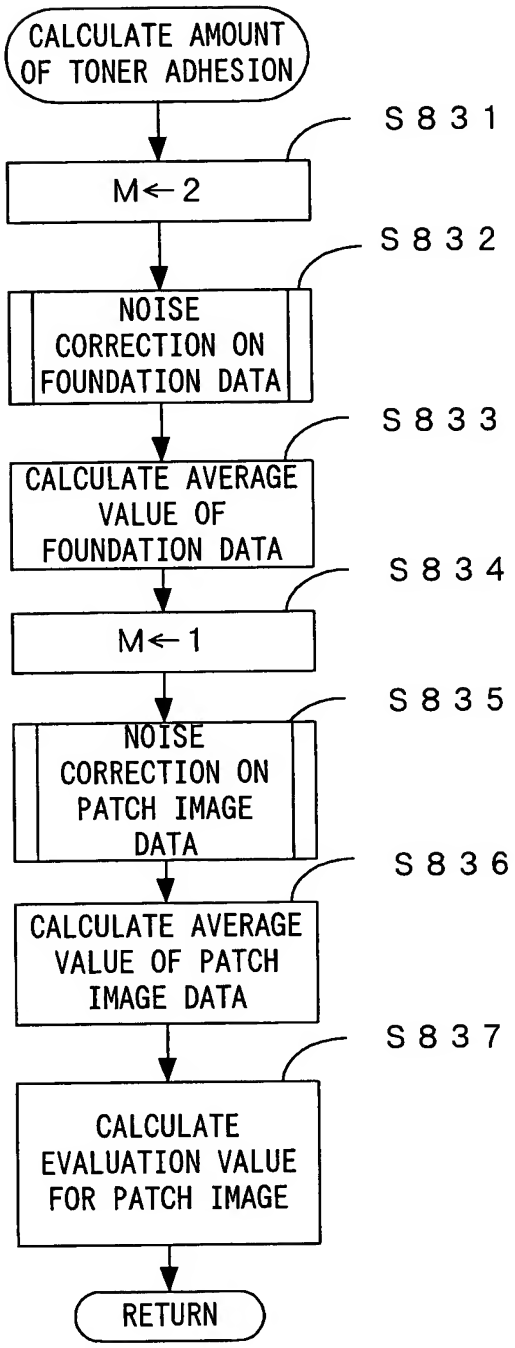

CALCULATE AMOUNT OF TONER ADHESION
S831
M←2
S832
NOISE CORRECTION ON FOUNDATION DATA
S833
CALCULATE AVERAGE VALUE OF FOUNDATION DATA
S834
M←1
S835
NOISE CORRECTION ON PATCH IMAGE DATA
S836
CALCULATE AVERAGE VALUE OF PATCH IMAGE DATA
S837
CALCULATE EVALUATION VALUE FOR PATCH IMAGE
RETURN

FIG. 28

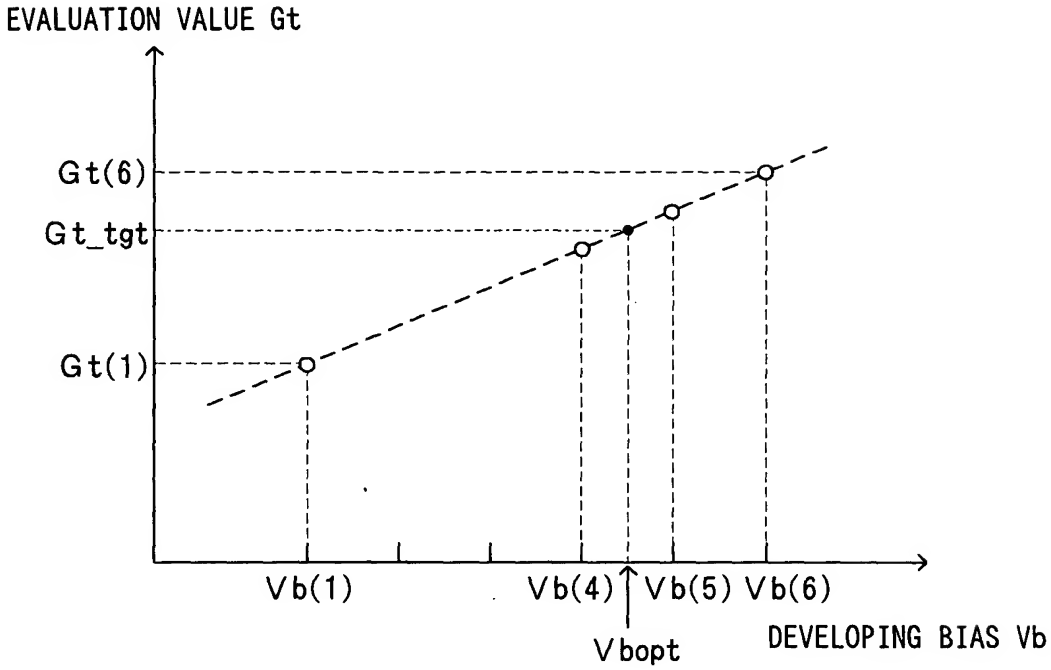

EVALUATION VALUE Gt
Gt(6)
Gt_tgt
Gt(1)
Vb(1)
Vb(4)
Vb(5)
Vb(6)
Vbopt
DEVELOPING BIAS Vb

FIG. 29

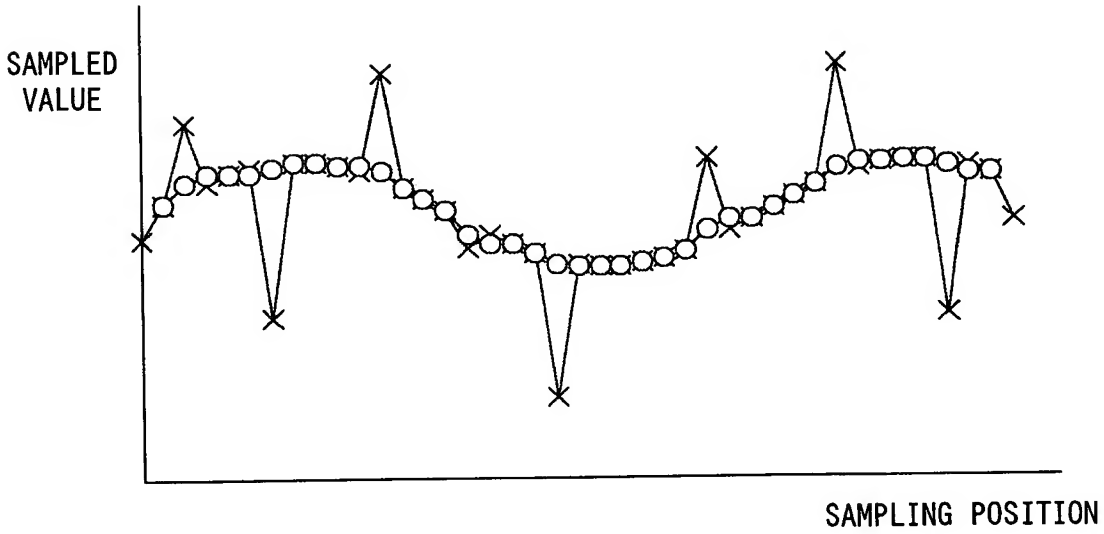


FIG. 30

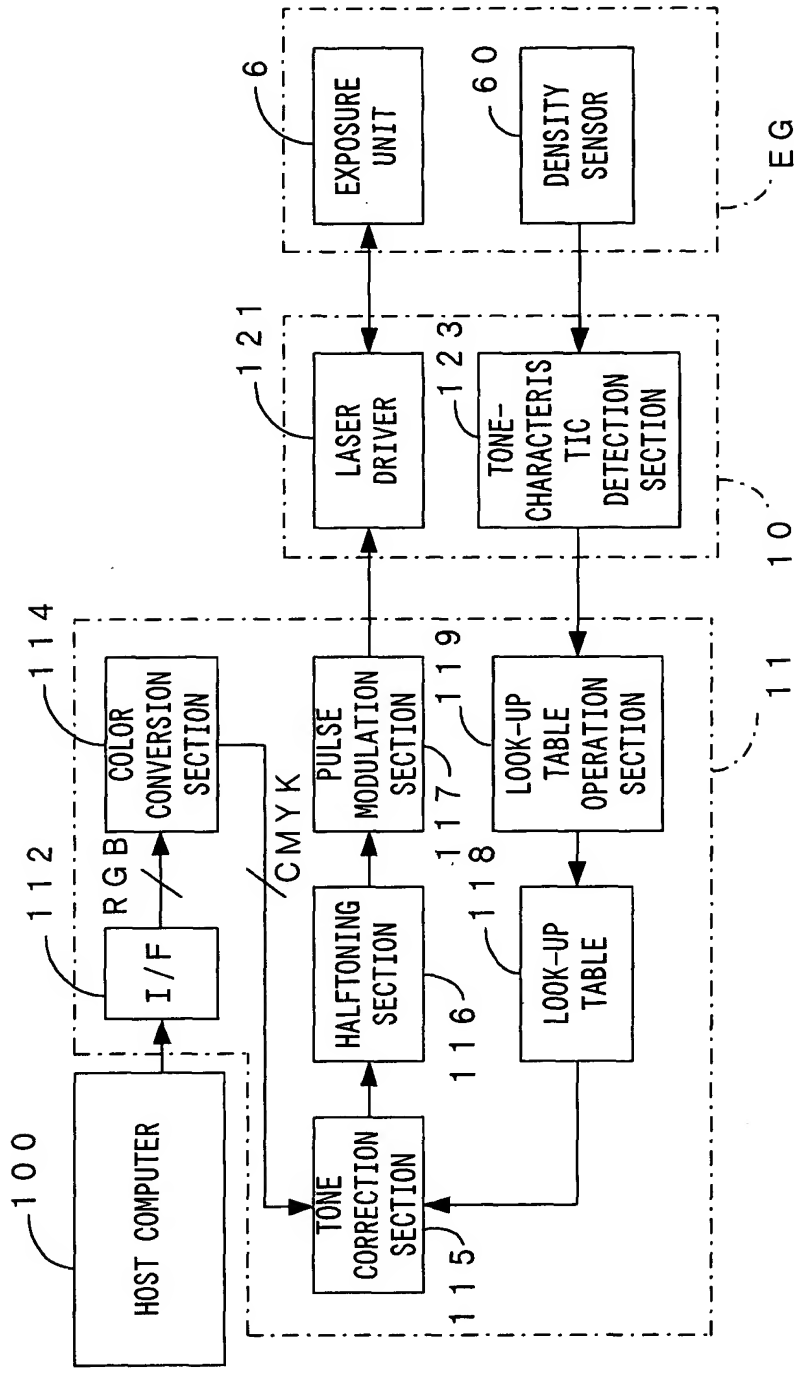

HOST COMPUTER
100
I/F
112
RGB
COLOR CONVERSION SECTION
114
CMYK
TONE CORRECTION SECTION
115
HALFTONING SECTION
116
PULSE MODULATION SECTION
117
LOOK-UP TABLE
118
LOOK-UP TABLE OPERATION SECTION
119
11
LASER DRIVER
121
TONE-CHARACTERISTIC DETECTION SECTION
123
10
EXPOSURE UNIT
6
DENSITY SENSOR
60
EG

FIG. 31A

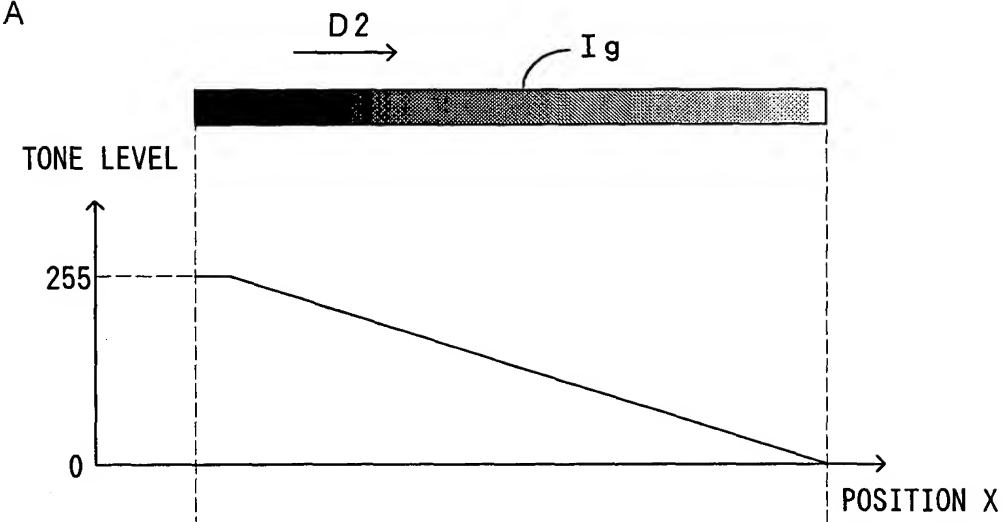


FIG. 31B

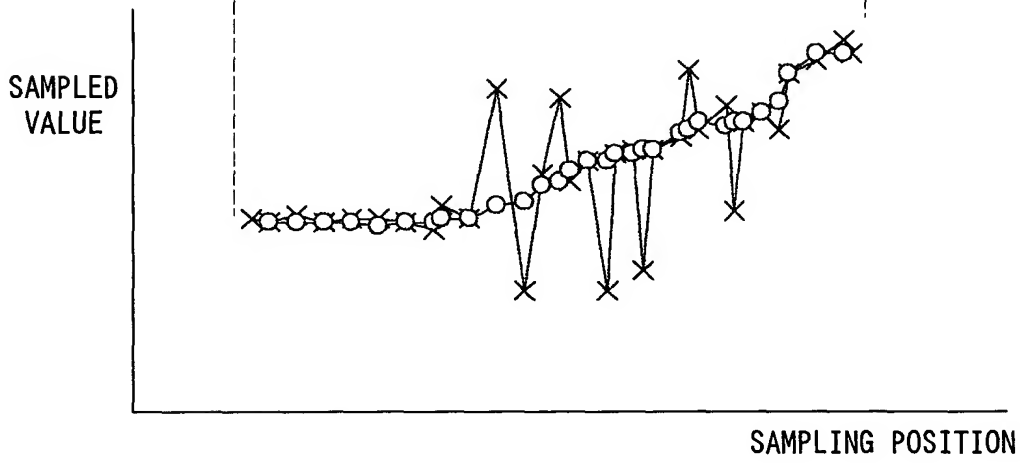


FIG. 32

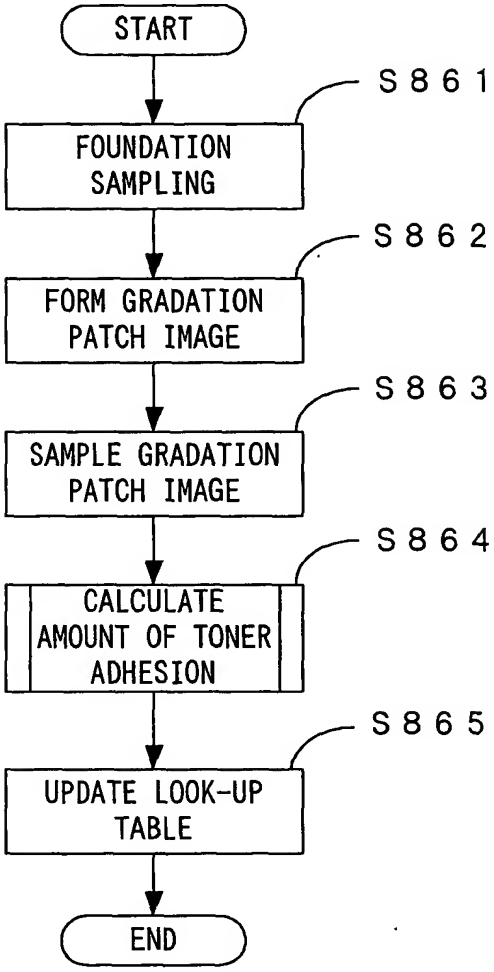
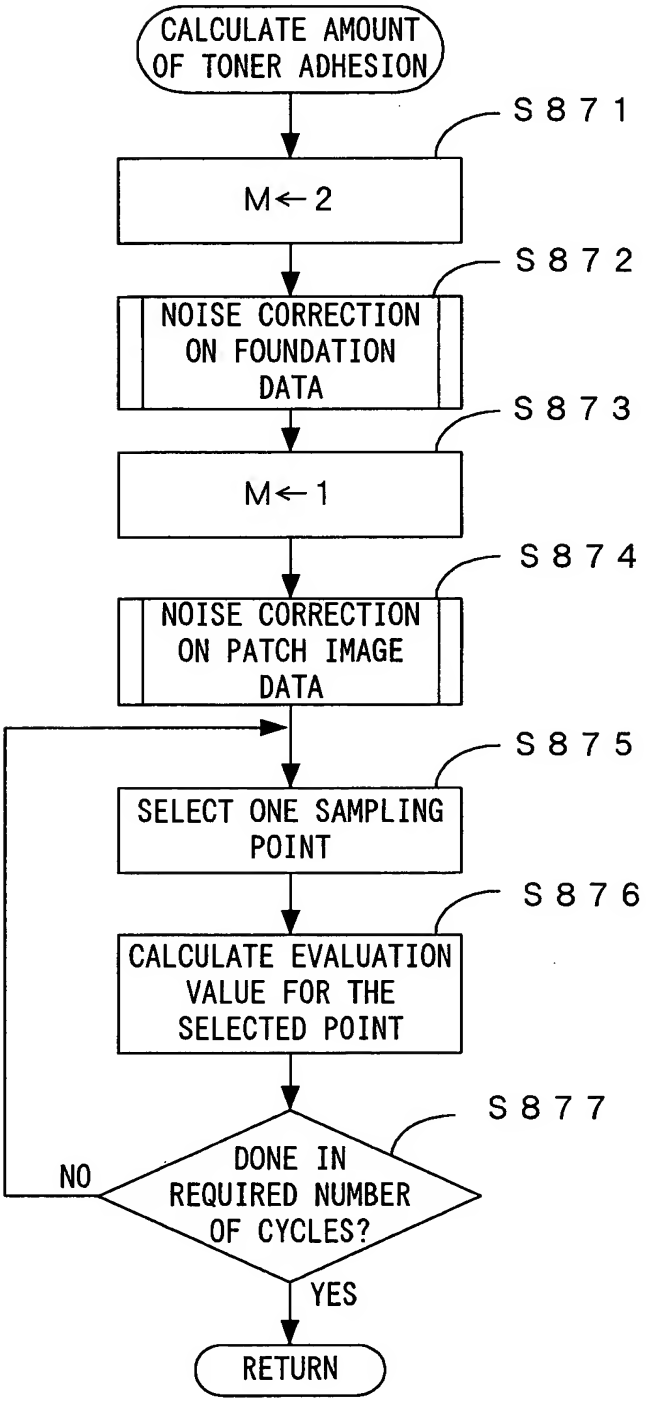

START
S861
FOUNDATION SAMPLING
S862
FORM GRADATION PATCH IMAGE
S863
SAMPLE GRADATION PATCH IMAGE
S864
CALCULATE AMOUNT OF TONER ADHESION
S865
UPDATE LOOK-UP TABLE
END

FIG. 33


CALCULATE AMOUNT OF TONER ADHESION
S871
M←2
S872
NOISE CORRECTION ON FOUNDATION DATA
S873
M←1
S874
NOISE CORRECTION ON PATCH IMAGE DATA
S875
SELECT ONE SAMPLING POINT
S876
CALCULATE EVALUATION VALUE FOR THE SELECTED POINT
S877
DONE IN REQUIRED NUMBER OF CYCLES?
NO
YES
RETURN

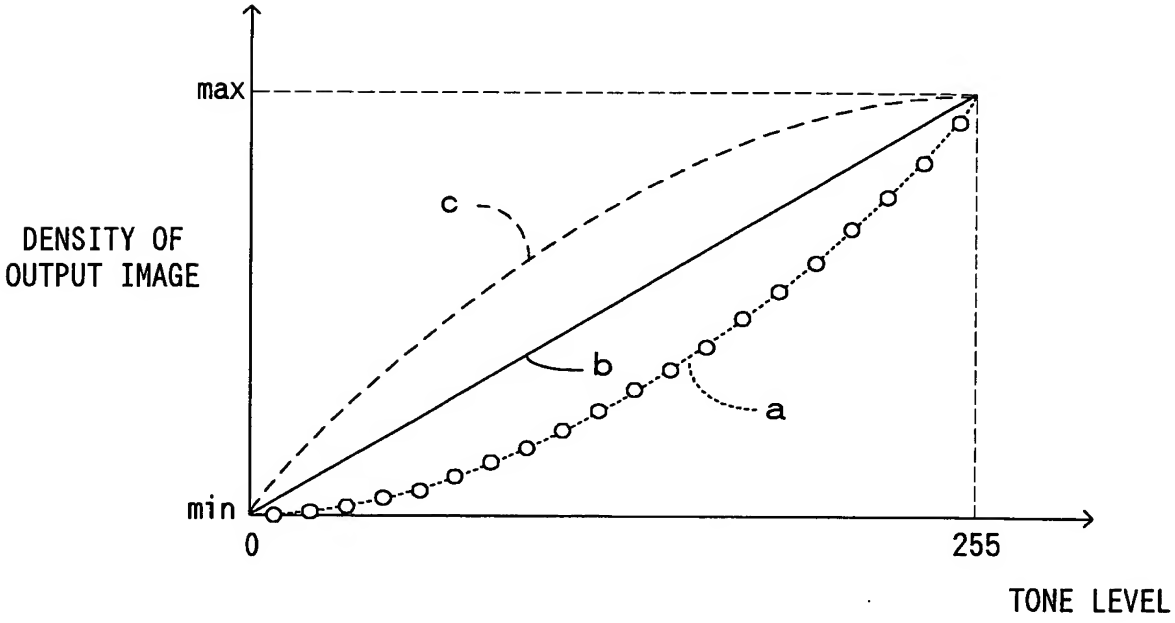



FIG. 34